

the main control circuit comprises pipe handling control circuitry adapted to
5 receive data from the pipe handling sensor group and to automatically
operate the pipe handling function.

28. (New) The drilling system of claim 25 wherein the main control circuit
automatically operates the fluid control function by sending at least one control signal to the fluid
dispensing assembly.

29. (New) The drilling system of claim 25 wherein:
the plurality of sensors comprises a fluid dispensing system sensor group
comprising a selected set of the plurality of sensors; and
the main control circuit comprises fluid dispensing control circuitry adapted to
5 receive data from the fluid dispensing system sensor group and to
automatically operate the fluid control function.

AI 30. (New) The drilling system of claim 29 wherein the fluid dispensing
system sensor group comprises:

an operating sensor adapted to transmit a signal when the fluid dispensing system
is required to be operational;

5 a flow rate sensor adapted to monitor the rate of flow from the fluid dispensing
system and transmit a flow rate signal to the fluid dispensing control
circuitry;

a fluid pressure sensor adapted to monitor the output of the fluid dispensing
system and transmit a fluid pressure signal to the fluid dispensing control
10 circuitry; and

a flow sensor adapted to detect presence of fluid flow and transmit a fluid flow
signal to the fluid dispensing control circuitry.

31. (New) The drilling system of claim 29 wherein the fluid dispensing control circuitry operates the fluid control function by sending at least one control signal to the fluid dispensing assembly in order to control an output of the fluid dispensing system.

32. (New) The drilling system of claim 25 wherein the main control circuit automatically operates the guidance control function by sending at least one control signal to the drive system.

33. (New) The drilling system of claim 25 wherein:

the plurality of sensors comprises a guidance control sensor group comprising a selected set of the plurality of sensors; and

the main control circuit comprises guidance control circuitry adapted to receive data from the guidance control sensor group and to automatically operate the guidance control function.

34. (New) The drilling system of claim 25 wherein at least one of the sensors in the guidance control sensor group are selected from the group comprising a thrust circuit output sensor, a rotation circuit output sensor, a carriage position output sensor, a rotation circuit speed sensor, and a product tension sensor, wherein:

the thrust circuit output sensor is adapted to monitor and transmit thrust applied to the drill string to the guidance control circuitry;

the rotation circuit output sensor is adapted to monitor and transmit rotation applied to the drill string to the guidance control circuitry;

the carriage position output sensor is adapted to monitor and transmit a relative position of a carriage to the guidance control circuitry;

the rotation circuit speed sensor is adapted to monitor and transmit rotational speed of the drill string; and

the product tension sensor is adapted to monitor and transmit tension exerted at the downhole tool to the guidance control circuitry.

35. (New) The drilling system of claim 33 wherein the guidance control circuitry operates the guidance control function by sending at least one control signal to the drive system.

36. (New) The drilling system of claim 25 wherein:
the plurality of sensors comprises a tracking sensor group comprising a selected set of the plurality of sensors; and
the main control circuit comprises tracking circuitry adapted to receive data from the tracking sensor group and automatically operate the tracking function.

37. (New) The drilling system of claim 36 wherein at least one of the sensors in the tracking sensor group is selected from the group comprising a roll sensor, a pitch sensor, an azimuth sensor, and a temperature sensor, wherein:

the roll sensor is adapted to detect and transmit a roll position signal to the tracking circuitry;

the pitch sensor is adapted to detect and transmit a pitch signal to the tracking circuitry;

the azimuth sensor is adapted to detect and transmit an orientation signal to the tracking circuitry; and

the temperature sensor is adapted to detect and transmit a temperature signal to the tracking circuitry.

38. (New) The drilling system of claim 36 wherein the tracking circuitry automatically operates the tracking function by monitoring the location and orientation of the downhole tool.

39. (New) The drilling system of claim 25 wherein the main control circuit automatically operates the power management function by controlling power used by the drive system nad the fluid dispensing assembly.

40. (New) The drilling system of claim 25 wherein:
the plurality of sensors comprises a power management sensor group comprising
a selected set of the plurality of sensors; and
the main control circuit comprises power management circuitry adapted to receive
5 data from the power management sesnor group and automatically operate
the power management function.

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41. (New) The drilling system of claim 40 wherein at least one of the sensors
in the power management sensor group is selected from the group comprising an engine speed
monitor, a thrust circuit input sensor, a rotation circuit input sensor, and a fluid circuit input
sensor, wherein:

5 the engine speed monitor is adapted to detect and transmit an engine
output signal to the power management circuitry;

the thrust circuit input sensor is adapted to detect and transmit a signal
indicative of thrust applied to the drill string to the power
management circuitry;

10 the rotation circuit input sensor is adapted to detect and transmit a signal
indicative of rotation applied to the drill string to the power
management circuitry; and

the fluid circuit input sensor is adapted to detect and transmit a a signal
indicative of fluid flow to the power management circuitry.

42. (New) The drilling system of claim 40 wherein the power management circuitry automatically operates the power management function by controlling power used by the drive system and the fluid dispensing assembly.

43. (New) The drilling system of claim 23 wherein:
the horizontal drilling machine further comprises a pipe handling system adapted to extend the drill string;
the plurality of sensors comprises a pipe handling sensor group comprising a selected set of the plurality of sensors, the pipe handling sensor group adapted to detect at least one parameter characteristic of the operation of the pipe handling system; and
the main control circuit comprises pipe handling control circuitry adapted to receive data from the pipe handling sensor group and to automatically operate the pipe handling system.

44. (New) The drilling system of claim 43 wherein the drill string comprises a plurality of pipe sections connectable at threaded pipe joints.

45. (New) The drilling system of claim 44 wherein:
the pipe handling system comprises:
a pipe handling assembly adapted to transport pipe sections to and from a connection area; and
a drill string length modification assembly adapted to make up and break out the drill string;
the pipe handling sensor group comprises a pipe handling assembly sensor group and a drill string length modification sensor group; and
the pipe handling control circuitry comprises:

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handling assembly circuitry to receive data from the pipe handling assembly sensor group and to automatically operate the pipe handling assembly; and

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drill string length modification circuitry to receive data from the drill string length modification assembly sensor group and to automatically operate the drill string length modification assembly.

46. (New) The drilling system of claim 44 wherein:

the pipe handling system further comprises a pipe lubrication assembly adapted to lubricate selected pipe joints;

the pipe handling sensor group further comprises a pipe lubrication assembly sensor group; and

the pipe handling control circuit further comprises pipe lubrication control circuitry adapted to receive data from the pipe lubrication assembly sensor group and to automatically operate the pipe lubrication assembly.

47. (New) The drilling system of claim 43 wherein:

the horizontal drilling machine further comprises a fluid dispensing assembly adapted to pump fluid through the drill string to the downhole tool;

the plurality of sensors comprises a fluid dispensing system sensor group comprising a selected set of the plurality of sensors, the fluid dispensing system sensor group adapted to detect at least one parameter characteristic of the operation of the fluid dispensing assembly; and

the main control circuit comprises fluid dispensing control circuitry adapted to receive data from the fluid dispensing system sensor group and to automatically operate the fluid dispensing assembly.

48. (New) The drilling system of claim 43 wherein:

the plurality of sensors comprises a guidance control sensor group comprising a selected set of the plurality of sensors, the guidance control sensor group adapted to detect at least one parameter characteristic of the operation of the drive system; and

the main control circuit comprises guidance control circuitry adapted to receive data from the guidance control sensor group and to automatically operate the drive system in order to adjust the position of the underground tool in accordance with a selected bore path.

49. (New) The drilling system of claim 43 wherein:

the horizontal drilling machine further comprises a power system adapted to supply power to the drive system;

the plurality of sensors comprises a power management sensor group comprising a selected set of the plurality of sensors, the power management sensor group adapted to detect at least one parameter characteristic of the operation of the power system; and

the main control circuit comprises power management circuitry adapted to receive data from the power management sensor group and to automatically operate the power system.

50. (New) The drilling system of claim 43 wherein:

the plurality of sensors comprises a tracking sensor group comprising a selected set of the plurality of sensors; and

the main control circuit comprises tracking circuitry adapted to automatically detect the location and orientation of the underground tool.

51. (New) The drilling system of claim 43 wherein:

the plurality of sensors comprises a guidance control sensor group comprising a selected set of the plurality of sensors, the guidance control sensor group adapted to detect at least one parameter characteristic of the operation of the drive system; and

the main control circuit comprises guidance control circuitry adapted to receive data from the guidance control sensor group and to automatically operate the drive system while backreaming a borehole.

52. (New) The drilling system of claim 43 wherein the main control circuit is further adapted to record the actual location of a product installed in a pilot borehole during a backream operation.

53. (New) The method of claim 24 further comprising:

automatically controlling a power system providing power necessary to axially advance the drill string.

54. (New) The method of claim 24 further comprising:

automatically providing drilling fluid to the underground tool while axially advancing the drill string.

55. (New) The method of claim 24 further comprising:

automatically extending a drill string used to axially advance the underground tool along the selected bore path.

56. (New) The method of claim 24 further comprising:

automatically tracking the position of the underground tool along the selected bore path.